CASE REPORTS

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Pheochromocytoma

Report of a Case with Preoperative Diagnosis and Removal Through Anterior Abdominal Incision

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WITH the introduction of the "benzodioxane test" by Goldenberg, Snyder and Aranow[4] in 1947 and the "histamine test" by Roth and Kvale,[5] a means was provided of diagnosing the presence of epinephrine-producing tumors (pheochromocytomata) with a fair degree of accuracy, even in patients with persistent hypertension from the long continued effect of the secretion of such a tumor.

In a majority of reported cases, successful surgical removal of all pheochromocytoma tissue has produced a lasting restoration of blood pressure to normal. The following case is presented to illustrate a typical example of a pheochromocytoma diagnosed by the use of benzodioxane (933F or 2 piperidine - methyl - 1,4 benzodioxane) and histamine tests and removed successfully by way of a transverse anterior abdominal incision.

The patient, a 36-year-old white poultryman, was referred to Wadsworth General Hospital on May 10, 1949, because of hypertension. Blurred vision in the left eye had developed approximately six weeks prior to admission and blurred vision in the right eye three days before admission. Since 1943 the patient had had frequent headaches, described as throbbing in nature. Often during a severe episode of headache he would have a sensation of seeing blinding light, which was synchronous with each heartbeat. Frequently the headaches were accompanied by "cold sweats" and a sensation of trembling and shakiness.

The patient also noticed the gradual onset of dyspnea on exertion during the six months prior to admission. He had nocturia (two to three times) and, on one occasion, three months before admission, the urine was pink in appearance. There had been a weight loss of ten pounds during the previous six months.

PHYSICAL EXAMINATION

Upon physical examination the patient was observed to be well developed, moderately well nourished, and apparently not in acute distress. The temperature was 98.6° F., the pulse rate 110, and respirations 16 per minute.

The pupils of the eyes were round and equal and reacted to light and accommodation. Extraocular movements were normal. Papilledema was present in both eyes—one diopter in the right and two in the left. There was generalized and localized attenuation of arterioles and a two and one-half to one vein-artery ratio. There was mild arteriovenous compression and copper-wire appearance of the arterioles. Flame-shaped hemorrhages and cotton-wool exudates were observed throughout the fundi of both eyes. Visual acuity was 20/40 in each eye.

The heart rate was rapid and was in normal sinus rhythm. There was no cardiac enlargement to percussion. A coarse grade II systolic murmur at the apex was noted. The blood pressure was 160 mm. of mercury systolic and 120 mm. diastolic.

The liver was palpated about one fingerbreadth below the costal margin.

LABORATORY EXAMINATIONS

Results of laboratory examinations of the blood were reported as follows:

Erythrocytes	4,100,000
Hemoglobin value	82 per cent
Leukocytes	11,000
Neutrophils	65
Lymphocytes	31
Monocytes	1
Eosinophils	1
Basophils	2
Sedimentation rate	20 mm. in one hour
Urea nitrogen	34 mg. per 100 cc.
Sodium	141 milliequivalents
Potassium	4.5 milliequivalents
Chloride	100 milliequivalents
Urea clearance	31 per cent
Serologic tests	Negative for syphilis

Specific gravity of the urine in a Fishberg concentration test was 1.016, 1.020 and 1.016. There were 100,000 hyaline casts, 100,000 granular casts, 4,500,000 leukocytes, 3,100,000 erythrocytes, and 500,000 epithelial cells in a concentrated urine specimen (Addis method). In routine urinalysis, five to eight leukocytes per high power field, and a few fine and coarse granular casts, were noted. The reaction for albumin was three plus. Urinary protein excretion (Esbach method) was 0.84 gm. in 24 hours. In an electrocardiogram there was a small Q in V_1, flat T in AVF, low T_1 and T_2, flat T_3 and a small Q in V_4, V_5 and V_6. The tracing was interpreted as being abnormal but not diagnostic. An x-ray film of the chest was normal.

In an intravenous pyelogram (Figure 1) the right kidney was observed to be essentially normal. The left kidney was poorly visualized but no definite mass could be seen. Carmelin blue dye injected intravenously was excreted poorly by both kidneys.

BLOOD PRESSURE STUDIES

Pronounced variations were noted in daily blood pressure determinations. The range was from 152 mm. of mercury systolic and 92 mm. diastolic to 260 mm. and 160 mm. respectively. At the time the highest level was recorded, the patient complained of severe, throbbing headache. This

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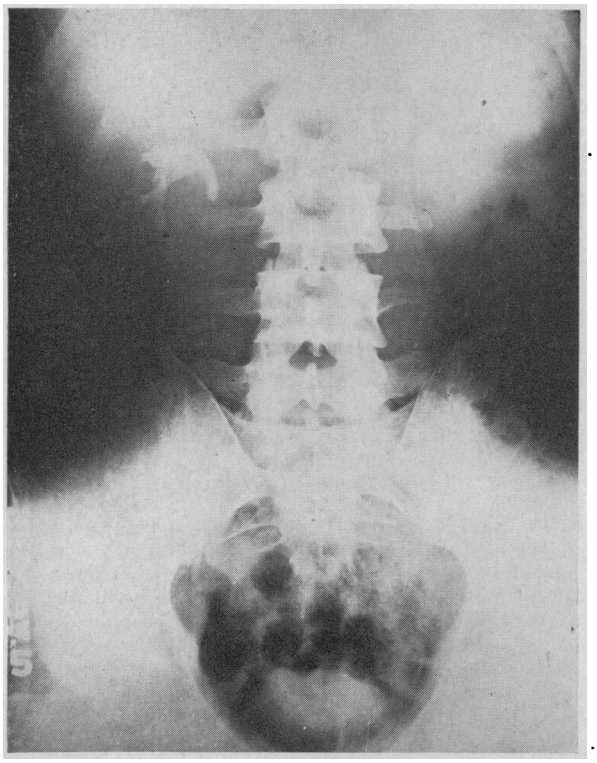


Figure 1.—Intravenous pyelogram showing inadequate visualization of the left kidney. This was thought to be due to the presence of a pheochromocytoma on the left. However, intravenous pyelogram following operation was similar to preoperative film.

episode was accompanied by coldness of skin associated with cold perspiration covering the body, a "glassy-eyed" appearance, and a slightly dazed condition. These symptoms subsided after about an hour, at which time the blood pressure was 160 mm. of mercury systolic and 120 mm. diastolic. The patient stated that he had had numerous similar episodes. A benzodioxane test was done May 23, 1949. Twenty milligrams of benzodioxane was given intravenously. The blood pressure decreased from 174 mm. systolic and 124 mm. diastolic to 150 mm. and 78 mm. respectively within four minutes (Chart 1). Seven minutes later the blood pressure was 160 mm. systolic and 100 mm. diastolic. The test result was considered positive. On May 26, 1949, a Roth-Kvale test was carried out. The blood pressure at the time of intravenous injection of 0.025 mg. of histamine was 150 mm. of mercury systolic and 100 mm. diastolic. Five minutes later it was 240 mm. and 170 mm. respectively. At this time, the patient complained of headache; the skin was cold and clammy, and there was cold perspiration over the entire body. An ampule of benzodioxane was opened, but the drug was not given because the blood pressure began to decline. (See Chart 2.)

Upon massage of the abdomen in the region of the left adrenal gland the blood pressure rose from 142 mm. of mercury systolic and 92 mm. diastolic to 150 mm. and 94 mm. respectively. With massage of the corresponding position on the right side, the pressure rose from 140 mm. systolic and 96 mm. diastolic to 144 mm. and 100 mm. The changes in pressure were not considered significant. On May 31, 1949, three weeks after the patient was admitted to the hospital, bilateral exploration of the adrenal glands was carried out. The preoperative diagnosis was pheochromocytoma of the left adrenal cortex.

Chart 1.—20 mg. benzodioxane produced a pronounced fall in the blood pressure. Curve is consistent with diagnosis of pheochromocytoma.

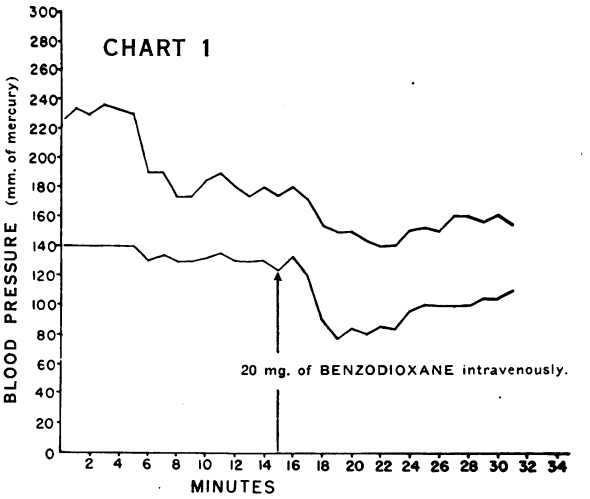
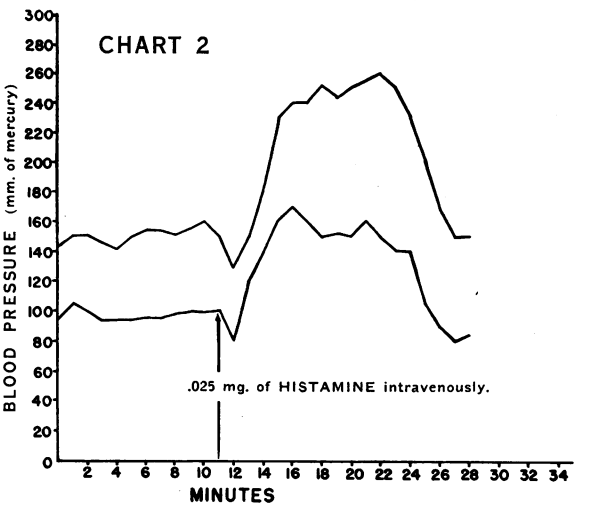


Chart 2.—Record of blood pressure following injection of 0.025 mg. of histamine, showing typical rise associated with pheochromocytoma.



OPERATION

The patient was anesthetized with cyclopropane and ether and the peritoneal cavity entered through a long, bilateral, subcostal, curved incision. The region of the right kidney and right adrenal gland was palpated; the right kidney was in normal position and of normal size. The right adrenal gland could not itself be identified, but there was no evidence of tumor in this area. In the region of the left kidney a mass, 7 to 8 cm. in diameter, was palpated. It lay along the upper pole of the left kidney, in the retroperitoneal space. The stomach was retracted downward and the lesser omentum incised in a direction parallel to the lesser curvature of the stomach. The left gastric vessels were rather long and it was possible to retract these to the right with a Deaver retractor. The lesser omental bursa and the tumor were exposed upon retraction of the lesser curvature of the stomach to the left. The peritoneum over the tumor was incised. The splenic vein and artery were identified and the pancreas, together with these vessels, was retracted downward, a procedure which exposed the anterior surface of the tumor. A large adrenal vein, about 7 to 8 mm. in diameter, coursed

along the lower anterior border of the tumor and entered the left renal vein. The anterior approach permitted excellent exposure of this vessel for ligation and division. During the period of manipulation of the tumor, the patient's systolic blood pressure rose to 220 mm. of mercury. This pressure was not affected by ligation of the large adrenal vein. The tumor was completely encapsulated and was readily mobilized by blunt dissection. Doubly clamping, dividing and ligating the overlying tissue and vessels freed all except the posterior-inferior surface of the tumor. The splenic flexure of the colon was mobilized and retracted medially. Geronta's fascia was opened and the tumor was approached from the lateral inferior surface. This area was mobilized without difficulty, and the tumor was delivered into the peritoneal cavity. The remaining pedicle of the tumor was divided and ligated. At this time there was pronounced decrease in the blood pressure, but at no time did the systolic pressure fall below 100 mm. of mercury. The lateral opening in Geronta's fascia was closed. The abdominal incision was then closed in layers with catgut and silk. The patient withstood the operative procedure well and his condition remained good throughout.

DESCRIPTION OF SURGICAL SPECIMEN

The specimen consisted of a rather flat, ovoid, encapsulated, brownish tumor mass, approximately 8 x 6 cm. in greatest dimensions and up to 3 cm. in thickness. The capsule had apparently been slightly torn in one area in the course of surgical removal. Remnants of yellow attenuated adrenal cortex extended over a portion of the surface, covering an area about 5 cm. in length. The sectioned surface of the tumor was dull brown and was studded here and there by pinpoint hemorrhagic flecks.

In microscopic examination of numerous sections, a rather uniform cytologic pattern composed of large, polyhedral or spindle-shaped chromaffin cells was noted. The chromaffin cells contained abundant, finely granular cytoplasm which stained a peculiar dark magenta with hematoxylin and eosin. The tumor tissue was permeated by smaller and larger congested blood channels and it was mainly about these vessels that the whorls and bundles of tumor cells appeared to be oriented.

In one of the sections, residual adrenal tissue upon the surface of the tumor was observed. This tissue was composed largely of cortex, but did contain a compressed central strip of medullary tissue, the cells of which resembled those of the neoplasm.

The pathological diagnosis was pheochromocytoma of the adrenal medulla.

POSTOPERATIVE STUDIES

The patient received five milligrams of desoxycorticosterone acetate the day before operation. During the operative procedure, he received 1,000 cc. of blood intravenously and 10 cc. of Eschatin® intravenously immediately following the removal of the tumor. Epinephrine in oil was administered on six occasions during the first two postoperative days. The patient also received 10 to 20 cc. of Eschatin daily for one week postoperatively.

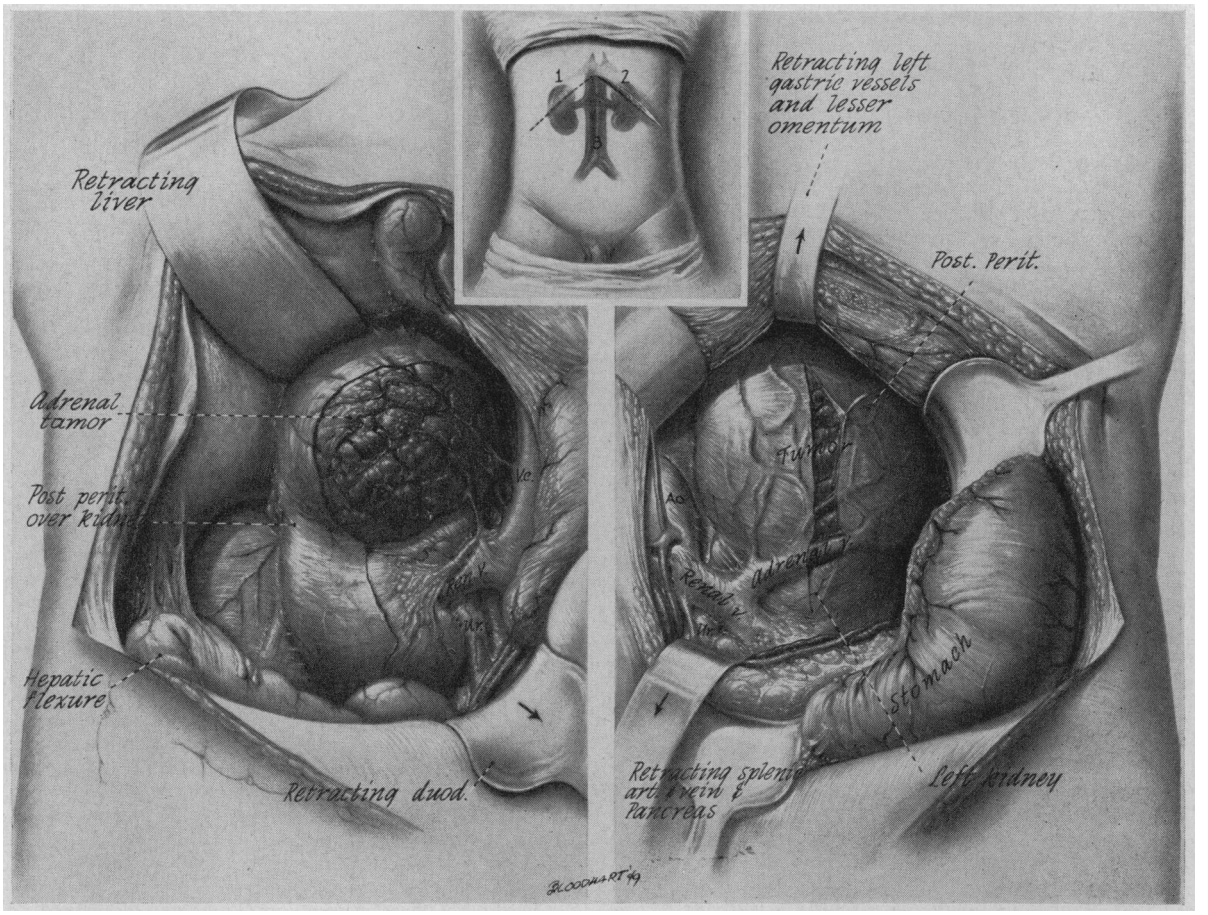
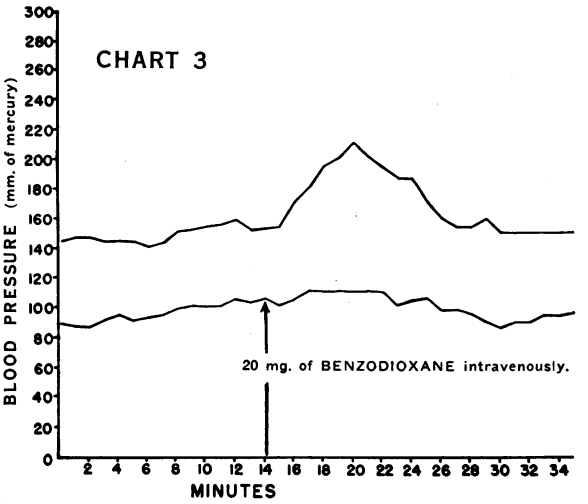


Figure 2.—Exposure of adrenal area through subcostal incision. *Left*—subcostal incision used in case reported, indicating exposure of tumor. *Right*—artist's conception of similar tumor of right adrenal gland exposed through right subcostal incision.

Following the patient's recovery from the operation, the blood pressure continued to be somewhat elevated, ranging from 140 mm. of mercury systolic and 80 mm. diastolic to 160 mm. and 100 mm. respectively. Urea clearance, determined June 20, 1949, was 72.5 per cent. Urea nitrogen in the blood was 14 mg. per 100 cc. A benzodioxane test was performed June 25, 1949. The blood pressure was 150 mm. of mercury systolic and 100 mm. diastolic before benzodioxane was given. After intravenous injection of 20 mg. of benzodioxane the blood pressure rose to 210 mm. systolic and 110 mm. diastolic and then gradually returned to 142 mm. and 90 mm. over a period of 15 minutes (see Chart 3). This was considered to be a rather typical response of essential hypertension. In an examination of the eyes on August 16, 1949, pronounced improvement was noted. There was no papilledema present. Although minimal constriction of some of the veins at arteriovenous crossings was observed, there was no deflection of the veins. There was some residual evidence of absorbing hemorrhage in both eyes. Cotton-wool exudates were not present. There were only minimal sclerotic changes in the retinal arterioles. Visual acuity in the right eye was 20/30, and in the left eye 20/30. An electrocardiogram was normal. Specific gravity of the urine (Fishberg concentration test) on August 16, 1949, was 1,021, 1,023, and 1,016. Results of urinalysis were normal. The urea nitrogen content of the blood was 16 mg. per 100 cc. The left kidney was poorly visualized in an intravenous pyelogram.

When last observed, five and a half months after operation, the patient was completely asymptomatic and was working eight hours a day. Blood pressure with the patient sitting

Chart 3.—Postoperative test with benzodioxane showed elevation of blood pressure, suggesting complete removal of pheochromocytoma. Response was one usually seen in essential hypertension.



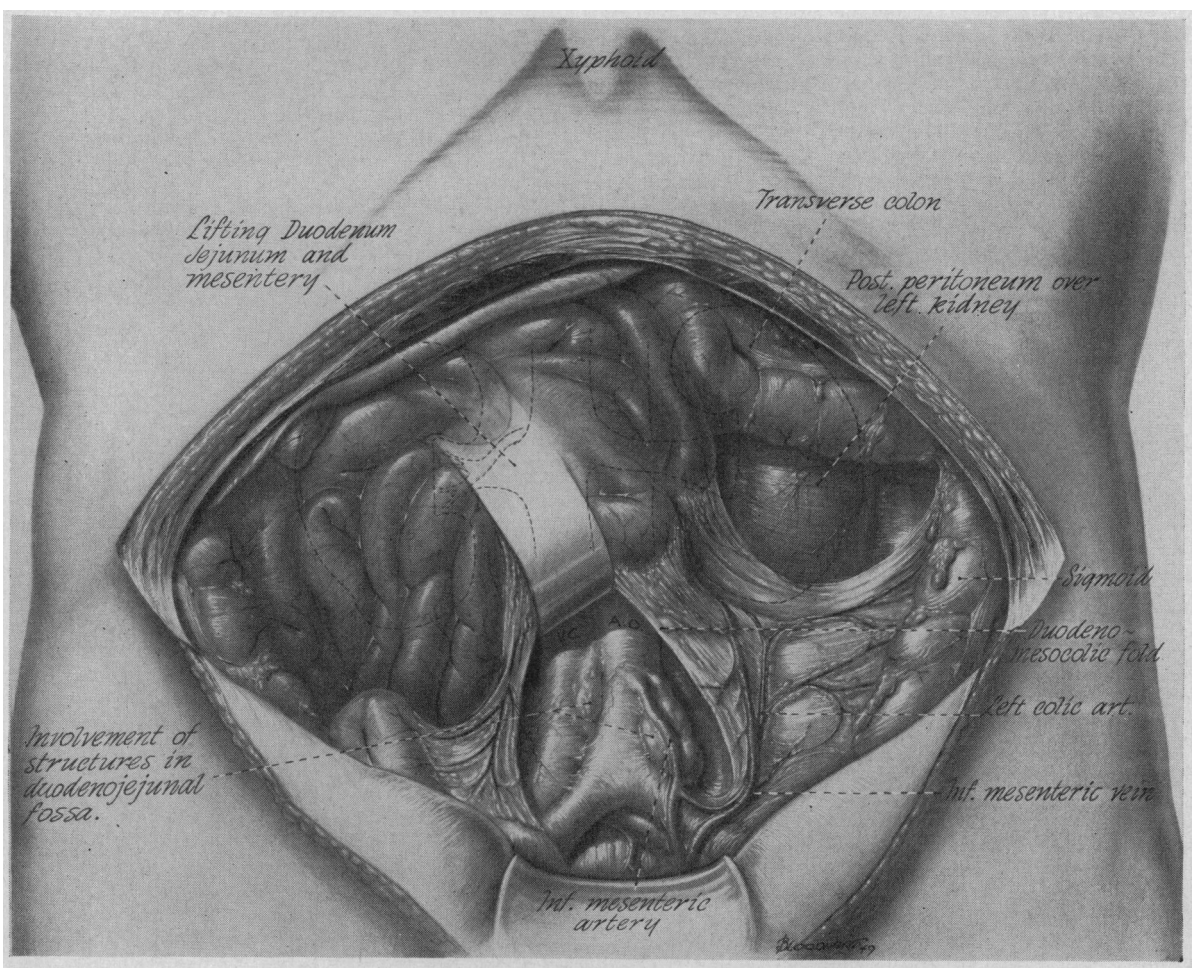


Figure 3.—Artist's conception of bilateral subcostal incision for exploration of suspected tumors of Zuckerkandl's bodies.

was 120 mm. of mercury systolic and 85 mm. diastolic; with the patient standing, 140 mm. and 100 mm. respectively. The slight hypertension which has persisted is probably secondary to the renal damage which occurred prior to the removal of the pheochromocytoma.

DISCUSSION

In most exploratory operations for adrenal tumors of this type, a posterolumbar incision has been used. The bilateral posterolumbar incision described by Young has been employed at times when the location of the tumor was uncertain before operation and when a tumor was not found associated with the adrenal gland first exposed. Other surgeons have preferred to perform the adrenal exploration transperitoneally through an incision in the anterior abdominal wall. Brunschwig, Humphreys and Roome[2] favor the anterior abdominal incision for the following reasons: "(1) Multiple tumors may be present, (2) There may be congenital absence of one adrenal gland, (3) Where, as in some reported instances, the tumor is on the anterior aspect of the kidney and adherent to surrounding tissues, sparing this kidney would be more feasible from an anterior approach than through a lumbar incision." Pneumoretroperitoneography for localization of the tumor is not without hazard and has not been used in many of the successfully treated cases. If localization of the tumor is not possible before operation, bilateral adrenal exploration is more readily performed through an anterior abdominal incision.

The benzodioxane test has been accepted in recent years as a relatively successful diagnostic procedure in cases in which pheochromocytoma is suspected. The efficacy of this drug was demonstrated in this case, not only in diagnosing the original condition, but also as a postoperative test to confirm the successful removal of the entire tumor. This drug has been employed as a diagnostic aid in examination of hypertensive patients at this hospital. No ill effect of the drug was observed in these studies. Drill[3] reported one case of nausea and headache and one in which precordial pain was noted following the use of the drug. The use of histamine injection as a diagnostic procedure is also considered to be hazardous because of the pronounced increase in blood pressure which may occur. Consequently, other drugs, such as tetraethylammonium bromide, are recommended in view of the fact that the blood pressure rise can be more easily controlled by postural changes.[6] The case described in this report again emphasizes the recessibility of many of the effects of a persistent elevated blood pressure, as is demonstrated by the pronounced improvement of the eyegrounds, in kidney function and in electrocardiogram tracings. Similar improvement has been noted by others (Bruce, Brunschwig, Kvale).

SUMMARY

A case of pheochromocytoma in a 37-year-old male who had typical attacks of paroxysmal hypertension, is reported. The diagnosis was confirmed by the use of benzodioxane and histamine tests.

A transverse upper abdominal incision was found to give adequate exposure for bilateral exploration of the adrenal glands and removal of the tumor.

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Dermoid Cyst of the Omentum

With Report of a Case

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IN a recent article dealing with omental cysts of clinical importance, Beahrs and Dockerty reviewed the literature on omental tumors and added 14 previously unreported cases of omental cysts. They divided omental tumors into solid and cystic. The cystic outnumbered the solid tumors in a ratio of 4 to 1. The malignant solid liposarcomas and fibrosarcomas were more frequent than the benign lipomas. Cysts of the omentum were subdivided into pseudocysts and true cysts. As examples of pseudocysts they cited cystic lesions following fat necrosis, those forming at the site of trauma with hematoma, those caused by reaction about a foreign body (such as gauze or petrolatum) and, most common, hydatid cysts. The true cysts were usually lined with epithelium or endothelium. Dermoid cysts, of which perhaps a dozen have been reported in the literature, were said to be examples of the epithelium-lined true cysts. Cysts which are probably congenital lymphangiomas but which might be the result of imperfect fusion of the opposed omental surfaces were cited as typical endothelium-lined cysts. Beahrs and Dockerty pointed out that the fewer than 100 cases of omental cysts in the literature probably did not represent the true incidence. The reported age range of patients was 3 months to 76 years, the majority of cysts occurring in the early years of life, 68 per cent among patients less than 30 years of age. Sixty per cent occurred in females. There was no racial predilection. The cysts were asymptomatic or the symptoms were caused by the size of the lesion, rupture of the cyst or torsion of the pedicle.

The following report of a case of dermoid cyst of the omentum is presented because the patient was older than any previously reported, because of the acute symptoms that were present owing to torsion and infarction, and because of the clinical and roentgenologic observations.

A 78-year-old white woman was admitted to the San Diego County General Hospital with a four-day history of shooting pain in the lower abdomen. The pain was intermittent but recurred with increasing frequency and severity. Marked anorexia developed on the day of entry. The

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